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On Explaining Morpheme Structure

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0. Introduction

In order to explain the existence of constraints on morpheme structure (henceforth CMSs),[1] early work in generative grammar (cf. Halle 1958, 1959, 1962; Chomsky 1964) posited a set of Morpheme Structure Rules (MSRs) which were of the same formal type as the other phonological rules of the grammar. Stanley (1967), after pointing out several problems with this kind of approach, proposed that the notion 'Morpheme Structure Rule' be banned from linguistic theory, and that it be replaced by a somewhat different formal construct, that of 'Morpheme Structure Condition' (MSC). Stanley allowed for three different kinds of MSCs, one of which (the 'If-Then' MSC) is, as he noted, a notational variant of the MSR; the others simply state whether a (sequence of) segment(s) satisfies a condition stated in either positive ('Positive' MSC) or negative ('Negative' MSC) terms.

More recently, Akers (1980) has argued for the incorporation of 'Admissibility Conditions' (ACs), which appear to be notational variants in many respects of Stanley's Positive MSCs, into linguistic theory, and Clements (1982) has proposed the adoption of 'Inadmissibility Conditions' (roughly the same as Stanley's Negative MSCs) as well. (The latter also argues that the 'Elsewhere Condition', which was originally proposed by Kiparsky (1973) as a constraint on the application of phonological rules, should be extended so that it governs the operation of CMSs.) Clements appears to be suggesting, moreover, that no equivalent of MSRs/If-Then MSCs is to be permitted. Kiparsky (1982), on the other hand, has argued in favor of the traditional MSR approach.

In this paper, I will present further arguments in favor of this latter kind of approach. After some brief remarks concerning Akers' approach, I will examine in some detail the analyses proposed by Clements, arguing that they provide no support for the AC approach or for the suggested extension of the Elsewhere Condition. Finally, I will consider briefly the relevance of data concerning the ways in which borrowed words can and cannot be nativized for choosing between the two types of approaches. The nativization data in fact provide evidence for a theory of MSRs that is considerably more restrictive than that advocated by Kiparsky, in that the set of possible MSRs is identical with the set of 'natural processes' (in the sense of Stampe (1973), Donegan and Stampe (1979))--a set which has a small finite number of members.

1. Against ACs

In addition to the arguments given by Stanley against the MSR approach, a number of further arguments have since appeared which are said to provide evidence against this framework. Since Kiparsky (1982) has, to my mind, successfully countered these arguments, I will concern myself only with the more recent admissibility approach of Akers and Clements.

While both Akers and Clements use the term 'Admissibility Condition', they appear to be using it in two quite different ways. Akers does not appear to intend that what he calls ACs be used to describe CMSs. Accounting for CMSs would apparently (though he never makes this explicit) require MSCs in addition to ACs. The latter function as a sort of filter on the application of a general, generative, rule that deletes all word-final consonants that are not permitted by the ACs. In this respect, they resemble very closely what Shibatani (1973) has called 'Surface Phonetic Constraints', although Akers confusingly compares his AC-based account with an If-Then MSC account. In any event, since they are not intended to describe CMSs, I will not consider them further here.

Clements, on the other hand clearly intends what he refers to as ACs to be used in accounting for CMSs. The essence of his argument is that adopting (a revision of) the Elsewhere Condition allows significant simplification in the statement of CMSs in at least two languages, Bobangi and Ngbaka. As Clements points out (p. 684), however, his argument depends on 'the assumption that [CMSs] are properly formulated as conditions of admissibility and inadmissibility', an assumption that he supports only by reference to Akers' work, where, as noted above, this term is used in a quite different fashion. I will argue here that the data discussed by Clements provide evidence, not for an extension of the domain of applicability of the Elsewhere Condition, but for a conception of CMSs other than that assumed by Clements--namely, the traditional MSR approach--in that much more revealing (in the case of Ngbaka, strikingly so) accounts of these data are possible within such a framework.

1.1. The Bobangi case

Clements' first illustration of the putative benefits of extending the Elsewhere Condition involves the formalization of a statement in Guthrie (1967, 46) concerning vowel cooccurrence restrictions in Bobangi. Guthrie's description (diacritics omitted) is as follows:

> (1) In position V_1 in this language there is a simple distinction of seven vowels, a/e/ɛ/i/o/ɔ/u. In position V_2 however there are a number of limitations according to the quality of V_1. Thus when V_1 is a, e, i, o, or u, we find only a/e/i/o/u as V_2, i.e. a distinction of five qualities only. When however V_1 is ɛ or ɔ in that case there are four distinct qualities only occurring as V_2, ɛ/i/ɔ/u.

Clements then gives (pp. 682-3) the following 'more succinct restatement', and then a reformulation of this restatement, of Guthrie's version:

> (2) The vowels ɛ, ɔ may not cooccur in a nominal stem with the vowels i, u, e, o, a, except that ɛ, ɔ may be followed by i, u.
>
> (3) In noun stems, the vowels ɛ, ɔ may be followed by i, u; otherwise ('elsewhere') ɛ, ɔ may not cooccur with i, u, e, o, a.

Clements' formalization of these constraints is as follows:

(4) $\begin{bmatrix}\text{-high}\\ \text{-advanced tongue root}\\ \text{-low}\end{bmatrix} C_o$ [+high] is admissible

(5) $\begin{bmatrix}\text{-high}\\ \text{-advanced}\\ \text{tongue root}\\ \text{-low}\end{bmatrix} C_o \begin{matrix}\alpha\text{advanced}\\ \text{tongue root}\\ -\alpha\text{low}\end{matrix}$ is inadmissible

mirror image

The incompatibility of these conditions, Clements suggests, can be overridden by appealing to the Elsewhere Condition, which he gives in the following form:

(6) Two adjacent rules of the form
A ---> B / P___Q
C ---> D / R___S

are disjunctively ordered if and only if:

a. the set of strings that fit PAQ is a subset of the set of strings that fit RCS, and
b. the structural changes of the two rules are either identical or incompatible.

The disjunctive ordering imposed by (6) prevents (5) from being applied after (4) has applied, since the structural changes involved (i.e., none) are in fact identical.

Clements' treatment does indeed express the Bobangi facts reasonably succinctly. But one might still want to know why the inadmissible sequences are not permitted. What does having opposite values for the features [low] and [advanced tongue root] (hereafter, [ATR]) have to do with anything? And why are segements so specified incompatible with nonadvanced mid vowels? Fortunately, these questions do not require answers, since they are, I will argue, simply artifacts of Clements' analysis. Note first of all that, if we ignore the facts concerning a, these constraints suggest a restricted vowel harmony system with respect to ATR of the type that, according to Greenberg (1963), was present in Proto-Bantu, and of roughly the type found in numerous other African languages (cf., for example, Stewart (1967), Clements (1974, 1981)): mid vowels must agree with the preceding vowel with respect to ATR.

Further evidence for this way of viewing the matter is that affixes with mid vowels show the alternations expected in a vowel harmony system of this type. As Whitehead (1899, 6) puts it:

(7) In the construction of a word [ɛ and ɔ] utterly refuse to be mixed up with [e and o]. Hence it will be found that the formative prefixes for nouns and formative suffixes for verbs must be made to harmonize with [these vowels].

Thus, for example, we find molendandalo 'a duty,' but mɔyɔtwanganɔ 'a writhing' (where mV is a noun class prefix).

As for the a problem, it is not clear that it exists, given the second form just cited, since ɔ follows a. However, since the post-prefix stretch in this case is likely to be morphologically complex (especially in view of its length, which is quite atypical of Bantu morphemes), and since the vast majority of Bobangi morphemes, as far as I can tell from Whitehead's examples and discussion (Guthrie does not offer any data in support of his claim), do obey the a constraint, this issue deserves some attention. What could cause a [-ATR] a to cooccur only with [+ATR] vowels (and itself)? Note that this is an especially curious state of affairs in a language that, as we have seen, requires mid vowels to agree in ATRness. One answer is that a is (or was, historically) converted to something else when in the environment of a [-ATR] vowel. Guthrie's comparative evidence (p. 46) supports this approach, as do the synchronic alternations in Bɔ/Bankon (cf. Spellenberg 1922), which appears to be fairly closely related to Bobangi (cf. Guthrie (1971)). Forms like mɔyɔtwanganɔ suggest that this process is no longer active synchronically in the language, so it is probably best to treat the (near?) lack of occurrence of a with [-ATR] vowels in morpheme-internal contexts as an accidental gap from a synchronic perspective.

If so, then the following statement accurately characterizes the structure of Bobangi nominals with respect to the vowel cooccurrence restrictions:

(8) If V_1 is not low and V_2 is mid, then these vowels must agree with respect to ATR; otherwise, any pair of vowels in the language may cooccur.

If we make the usual assumption that anything not prohibited by a MSR is permitted, the following MSR is all that is necessary to characterize the Bobangi constraints:

(9) $\begin{bmatrix}-\text{high}\\-\text{low}\end{bmatrix} \text{---> } [\alpha\text{ATR}] \; / \; \begin{bmatrix}-\text{low}\\ \alpha\text{ATR}\end{bmatrix} C_o \_\_\_$

Nothing needs to be said about the occurrence of [+ATR] high vowels after [-ATR] vowels, since these are the only high vowels in the language; that is, Bobangi has the following segment structure constraint (cf. Stanley 1967), some version of which would be necessary regardless of the approach adopted:

(10) [+high] ---> [+ATR]

If it should turn out that the a constraint is still alive (e.g., if loan words are nativized so as to conform to it), then the following mirror image rule would also be necessary:

(11) $V \text{ ---> } [-\text{low}] \; // \; \begin{bmatrix}-\text{low}\\-\text{ATR}\end{bmatrix} C_o \_\_\_$

That is, low vowels do not occur in the environment of nonlow, nonadvanced (hence mid) vowels.

It is possible to, in effect, mimic these rules within an admissibility framework. The conditions required are the following:

(12) $\begin{bmatrix}-\text{low}\\ \alpha\text{ATR}\end{bmatrix}\ C_o\ \begin{bmatrix}-\text{high}\\ -\text{low}\\ -\alpha\text{ATR}\end{bmatrix}$ is inadmissible

(13) $\begin{bmatrix}-\text{low}\\ -\text{ATR}\end{bmatrix}\ C_o\ [+\text{low}]$ is inadmissible
mirror image

Note that this account requires no appeal to the Elsewhere Condition. It is also simpler than Clements' account in terms of feature-counting, and an investigator who is familiar with vowel harmony systems found in African languages would probably be able to guess why the constraint in (12) holds, and perhaps why (13) does. But surely an account that does not require such guessing in order to understand the structure of the language (e.g., the MSR account just sketched) is to be preferred. Furthermore, a slight change in the formulation of (9) can account for the (bidirectional) vowel harmony across morpheme boundaries pointed out above:[2]

(9') $\begin{bmatrix}-\text{high}\\ -\text{low}\end{bmatrix}$ ---> [αATR] // $\begin{bmatrix}-\text{high}\\ -\text{low}\\ \alpha\text{ATR}\end{bmatrix}$ ___

It is also worth pointing out that the admissibility approach makes no prediction concerning how loan words will be nativized, whereas (9') predicts that mid vowels will assimilate to adjacent mid vowels with respect to [ATR], and (10) predicts that a will be raised in the environment of nonadvanced mid vowels.[3] While there appears to be no information available concerning the treatment of loan words in Bobangi, evidence from loan phonology in other languages (see section 2 below) indicates that the MSR approach is superior in this respect to the admissibility approach.

1.2. The Ngbaka case

Let us now turn to the Ngbaka data. Clements cites Wescott (1965) as giving the following characterization of vowel cooccurrence restrictions in this language (which has the same seven-vowel system as Bobangi):[4]

(14) If a disyllabic word contains /i/, it does not also contain /u/; if /e/, it does not also contain /ɔ/, /ɛ/, or /o/; if /u/, it does not also contain /i/; if /o/, it does not also contain /e/, /ɛ/, or /ɔ/; and if /ɔ/, it does not also contain /ɛ/, /e/ or /o/.

That is, Clements states (p. 684), 'in bisyllabic words containing no low vowel /a/, either the vowels are identical or they differ in height.' After rightly rejecting the extremely suspicious analysis proposed by

Chomsky and Halle (1968), Clements suggests the following conditions, which are governed by the Elsewhere Condition:

(15) $\begin{bmatrix} V \\ -low \end{bmatrix}_1 \; C_{o\,2} \; \begin{bmatrix} V \\ -low \end{bmatrix}_3$ is admissible

Condition: 1 = 3

(16) $\begin{bmatrix} \alpha high \\ -low \end{bmatrix} \; C_o \; \begin{bmatrix} \alpha high \\ -low \end{bmatrix}$ is inadmissible

Again, these conditions accurately characterize the restrictions in question. And again, one is left wondering why (16) should exist (although the existence of (15)--or a generalized version of it--is not at all surprising). Why is this language so unhappy with (non-low) vowels of the same height? The answer is, again, that we are dealing with a system of vowel harmony (not 'disharmony,' as (14) and (16) suggest). Thus, Clements' two conditions can be replaced by the following single MSR:

(17) $\begin{bmatrix} \alpha high \\ -low \end{bmatrix} \; ---> \; \begin{bmatrix} \beta back \\ \gamma ATR \end{bmatrix} \; / \; \begin{bmatrix} \alpha high \\ \beta back \\ \gamma ATR \\ -low \end{bmatrix} \; C_o \; \_\_\_$

That is, a nonlow vowel that agrees with respect to the feature [high] with the preceding vowel harmonizes with it with respect to <u>all</u> features. Thomas (1963,62) agrees with the spirit of this account, as she states that '...il y a dans cette langue une forte tendance a l'harmonie vocalique'.[5]

It must be admitted that the analysis just suggested requires the use of a greater number of features than Clements' proposal and it might be argued that the simplicity metric would therefore require adoption of the latter. However, as is well known (cf., for example, Chomsky and Halle (1968)), such a device can be reasonably applied only to analyses framed within the same theory. We do not have such a situation here, since the MSR theory does not allow conditions on admissibilty and inadmissibility, while the condition theory would not (I presume, although Clements does state this explicitly) allow MSRs. Even within a theory that allows both kinds of ways of accounting for CMSs, however, rule (17) should be chosen over (15) and (16), I would maintain.

Note first of all that it is not at all clear that the condition required in (15) should be cost-free. Neither is it obvious that specifications of admissibility/inadmissibility come at no cost. Furthermore, it appears that (15) would not be allowed by any reasonable evaluation measure (and certainly not by any I have seen proposed), since there is a more general version which is equally compatible with the Ngbaka data, namely one which states that <u>any</u> sequence of identical vowels (not just nonlow ones) is admissible:

(15') V $C_{o\,2}$ V is admissible
1 3

Condition: 1 = 3

With this simplified version, however, the required subset relation called for by the Elsewhere Condition is not met, and so (15') and (16) should apply conjunctively--an impossibility, given that they make partially incompatible statements. That is, the requirement that the vowels in (15) be nonlow is a purely ad hoc one, needed solely to insure that the Elsewhere Condition will be applicable. Thus, the analysis incorporating (15) and (16), though 'simpler' than that employing (17), is in fact ruled out on grounds of simplicity, unless perhaps one can come up with an evaluation measure that is somehow sensitive to the exigencies of the Elsewhere Condition in situations such as this.

But cannot an account analogous to the MSR account be framed within the admissibility approach? One might suggest the following:

(18) $\begin{bmatrix} -\text{low} \\ \alpha\text{high} \\ \beta\text{back} \\ \gamma\text{ATR} \end{bmatrix} C_o \begin{bmatrix} -\text{low} \\ \alpha\text{high} \\ \beta\text{back} \\ \gamma\text{ATR} \end{bmatrix}$ is admissible

While this condition does in fact characterize some admissible sequences in the language, it does not characterize all of them (the low vowel can co-occur with any vowel), and it says nothing about what is inadmissible. Moreover, changing this to an admissibility condition along the lines of the reanalysis of (12) and (13) is not possible in this case. What is inadmissible here is nonlow vowels of the same height that do not agree with respect to <u>either</u> [ATR] <u>or</u> [back]. Such a condition cannot be expressed without recourse to either Boolean conditions of the type that, as Clements points out (p. 684), do not appear to be otherwise required, or a disjunction such as that given below, which is generally taken as an indication that the relevant generalization has been missed (cf. Newmeyer 1980):

(18') $\begin{bmatrix} -\text{low} \\ \alpha\text{high} \\ \beta\text{back} \\ \gamma\text{ATR} \end{bmatrix} C_o \begin{bmatrix} -\text{low} \\ \alpha\text{high} \\ \{-\beta\text{back}, \\ -\gamma\text{ATR}\} \end{bmatrix}$ is inadmissible

Even if such formulations were permitted, moreover, no explanation would be provided for the inadmissibility of the inadmissible sequences (although again one familiar with vowel harmony systems might be able to guess the reason).

Thus, the Ngbaka facts discussed so far can be expressed in a revealing fashion, as far as I can tell, only within an MSR framework. In addition, the admissibility approach makes essentially no predictions about the treatment of loan words, which do in fact tend to harmonize, as noted above (see section 2 for further discussion of the general relevance of loan phonology).

A CMS not mentioned by Wescott[6] provides further evidence against the admissibility approach to the treatment of Ngbaka CMSs. Ngbaka is claimed by Thomas (1963, 63) to have the following CMS in addition to those discussed above:

(19) <u>u</u> does not cooccur with <u>o</u> or <u>ɔ</u>.

Within an MSR approach, this is just a further instance of vowel harmony, although the rule required in order to account for this CMS can apparently be only clumsily collapsed formally with (17). The separate rule required is, however, an extremely simple one (but cf. note 5):

(20) [+round] ---> [∝high] / [∝high] C_o ___

Within the admissibility approach, it would also seem to be all but impossible to incorporate the facts in (19) into the existing rules.[7] Presumably the simplest treatment would add the following:

(21) $\begin{bmatrix}+\text{round}\\ \propto\text{high}\end{bmatrix}$ C_o $\begin{bmatrix}+\text{round}\\ -\propto\text{high}\end{bmatrix}$ is inadmissible

This condition, which would be disjunctively ordered with respect to (16) by the Elsewhere Condition, is subject to all the criticisms made of the other conditions. In additon, its relationship to the other (putative) inadmissibility condition in the language is far from clear, since while in (16) vowels that agree in height are disallowed, here it is (rounded) vowels that disagree with respect to this same feature that are inadmissible. These facts thus appear to lend considerable support to the MSR approach.

Thus, the facts concerning Bobangi and Ngbaka by no means force one to weaken the Elsewhere Condition in the manner advocated by Clements, since alternative--and more revealing--accounts of these facts can be given. Moreover, these facts provide no evidence that the admissibility approach is to be preferred over the MSR approach; rather, assuming the relative undesirability of having disjunctions in rules, the Ngbaka facts--even if only those facts mentioned by Wescott are considered--suggest that just the opposite is in fact the case. And if the constraint in (19) holds, it seems to me, the case against the admissibility approach is overwhelming.

2. In favor of MSRs

It has been argued in a number of studies that the facts of loan phonology in Japanese and in Miami Cuban Spanish provide strong support for David Stampe's theory (see especially Stampe (1973), Donegan and Stampe (1979) of 'natural phonology' (cf. Ohso 1971, Lovins 1973, 1974, Bjarkman 1976)). To the evidence adduced in these studies, I would like to add some evidence from English. The English evidence is especially compelling, since it involves not only actual nativizations, but (intuitions about) impossible nativizations.

2.1. The English case

In English, */šl/ and */sr/ do not occur initially in native morphemes; /sl/ and /šr/, on the other hand, occur freely.[8] Since there is no evidence from morphophonemic alternations for a phonological rule involving such sequences, and since it would therefore appear to be arbitrary to choose either the first or second segment as the one which is 'changed' in a generative MSR, one might propose that this constraint should be stated in terms of a static MSC. Perhaps the most obvious candidate is the

following, where the AC formalism is employed:

(22) $\#\begin{bmatrix}+\text{continuant}\\+\text{strident}\\ \alpha\text{anterior}\end{bmatrix}\begin{bmatrix}+\text{vocalic}\\+\text{consonantal}\\ \alpha\text{lateral}\end{bmatrix}$ is inadmissible

Insofar as this condition (or any (in)admissibility condition) makes any predictions at all with respect to loan phonology, it implies that the impermissible sequences will be adjusted by altering either of the segments in question (presumably as little as possible). But the behavior of loan words in English suggests otherwise. Sri Lanka, for example, which has as a source an initial /sr/, is pronounced by most English speakers with /šr/; the alternative suggested by (22)--changing the second segment so that it is [+lateral] (i.e., /l/)--has been rejected as a possible nativization of this form by all of the speakers (more than twenty) I have consulted. Similarly, if a foreign item with initial /šl/ is to be nativized by altering one of these segments, only one nativization is possible. Schlitz, for example, is pronounced by many speakers with initial /sl/, but no one has */šr/, and speakers again reject this as a possible nativization when it is suggested to them.

There are, of course, other possibilities. One is to simply not nativize a form at all. Another is to avoid the problem by inserting an epenthetic schwa to break up the offending cluster, thus making the original process unnecessary by bleeding it. An interesting example where three different strategies are found involves the surname Schlichter, a name much in the news recently due to the fact that one of its bearers, an ex-OSU football star, was involved in a gambling scandal. While many newscasters pronounce this name with an initial /sl/, Mr. Schlichter himself has /šəl/, and others, including myself, have what is presumably the 'correct' pronunciation with /šl/. (In this case, it seems likely that the epenthesis rule is being used for a functional reason--to avoid changing the initial /š/, which is apparently felt by Mr. Schlichter to be an important part of the name, to /s/ by the process applied by the nativizing newscasters; see below for a statement of this process.) What is not found is /šr/. More importantly, it could not be found--such a sequence is not a possible way of nativizing initial /šl/.

Since only one set of segments can be changed in such cases, it appears that an MSR approach is required in order to account for these nativization facts; the MSR analogue of (22) is:

(23) $\begin{bmatrix}+\text{continuant}\\+\text{strident}\end{bmatrix}$ ---> [αanterior] / # ___ $\begin{bmatrix}+\text{vocalic}\\+\text{consonantal}\\-\alpha\text{lateral}\end{bmatrix}^{9}$

The thoroughgoing directionality in nativizations (and impossible nativizations) such as these simply cannot be accounted for within a static condition-based approach.

In a sense, it is unfortunate that recourse must be made to 'external evidence' of this type, for it seems clear that the child does not have access to such evidence when developing his/her phonological system. Insofar as we cannot predict the system acquired solely on the basis of the

kind of evidence available to the child, there can be no explanation of how language acquisition is achieved in this area; that is, to use Chomsky's (1964, 1965) terminology, we would not have an explanatorily adequate theory of morpheme structure. But if the child brings to phonological acquisition more than just a data processing ability--in particular, if the child 'knows' that CMSs are expressed by means of MSRs--then the child is not in as bad a position as the linguist, who has no way of knowing a priori that the MSR approach is in fact required. I therefore propose that a universal principle to this effect be incorporated into phonological theory:

(24) All CMSs must be expressed in terms of MSRs.

Even this is not enough to guarantee that child will (as all English-speaking children apparently do, in view of the above discussion) learn rule (23) rather than a rule that alters the second segment in such sequences, or one of numerous imaginable alternatives such as deleting one of the segments in question. Note that operations analogous to these latter impossible alternatives are in fact found when other kinds of sequences are involved: s + voiced stop clusters that arise due to casual speech simplifications are altered by devoicing the stop, as in [sko] for Let's go (cf. Stampe 1973), whereas loan words which begin with a stop-initial cluster lose their first member (pterodactyl, pneumonia). That is, the following MSRs (given in very rough form) are operative:

(25) a. [-sonorant] ---> [-voiced] / #s ___

b. [-continuant] ---> ∅ / # ___ C

We now have two further MSRs whose acquisition seems puzzling, since here again there appears to be no good reason why these rules should take the form that they do, rather than any of the numerous alternatives. The only reasonable answer, it seems to me, is that we are asking the wrong question. These CMSs are not acquired, but rather are, like other Stampean 'natural processes', innate; what is involved in (the natural part of) phonological acquisition is not learning the rules of the language, but suppressing the processes that are not operative. Thus, for example, while English requires that successful learners suppress the natural process that devoices final obstruents, it does not require suppression of the rules in (23) and (25), and the effects of these latent processes show up clearly if we look in the right places. Similarly, final devoicing need not be suppressed when acquiring, say, German, and its effects are also seen in the areas of loan phonology and 'foreign accent' (as well as in the phonology proper). That is, English speakers did not learn (23) and (25)--they simply did not, because the language they were learning did not force them to, unlearn them.

2.2. General consideration

If the above CMSs are the result of the operation of unsuppressed natural processes, then it is not unreasonable to suppose that all CMSs that are synchronically valid (and not just the essentially accidental effect of the occurrence of one or more historical changes) have a similar explanation. That is, it appears that (24) can be strengthened, as follows:

(24') All (synchronically valid) CMSs must be expressed in terms of natural processes.

The attribution of innate constructs may be found unpalatable by some, especially when they are as specific as they are in this case. One might also question the conclusion reached on the grounds that the data involved are of an 'external' type, and that they moreover involve, at least in part, 'nonempirical' intuitions. But when the intuitions in question are as unanimous as they are in this case, it seems clear that they require an explanation of some kind. Given the lack of plausible alternative explanations--and I at least cannot even begin to think of one--the present proposal is what one must be driven to. In fact, I feel, use could profitably be made of intuitions about impossible occurrences in other types of external evidence such as language games (cf. Churma 1979, ch. 5). One of Chomsky's greatest contributions to linguistics, in my view, is his heavy reliance on 'impossibility' data in syntax (i.e., ungrammaticality data), despite the fact that, as Baker (1979) has pointed out, this kind of impossibility data is not, for the most part, available to the learner. But this does not mean that we should abandon the use of ungrammaticality judgments in syntactic research; the child has a big head start over us, and we need to make use of every piece of relevant data we can find just to discover the nature of the system acquired by the child--let alone explain how this system is acquired. This is no less true in phonology (or morphology or any other part of the linguistic system) than it is in syntax.

Since it seems clear that we have as yet only a rudimentary knowledge of what is contained in the set of natural processes, it is perhaps worthwhile to consider briefly the possibility of the existence of more general universal principles which, though not the ultimate explanation (for this is the responsibility of the individual processes themselves), might serve both as a basis for a somewhat different way of understanding the existence of the innate processes and as a partial heuristic for doing phonological analysis. To this end, I suggest the following, which can be considered to be inductively supported by the above discussion:

(26) a. There are no natural processes of vowel dissimilation (or their notational equivalent), either in the area of morpheme structure or elsewhere in phonology.[10]

b. Greek letter variables may not be used to pair different feature specifications in a natural process.

Assuming that all of the above discussion is concerned with natural processes (and cf. (24') above), the first of these metaconstraints would prohibit the use of rule (16), and the second, which is essentially equivalent to the claim that such variables may be used only in rules of assimilation and dissimilation, would disallow (5) and (19) (and (22)--cf. note 7) and various other suspicious analyses, such as that of Rood (1975), where alpha variables are employed to characterize the class consisting of /s/ and /?/ in a simple ('natural') fashion. Any regularity that appears to require violation of one of these constraints, I would maintain, is either an accidental one or can be expressed in more revealing fashion within a different framework--as was seen to be the case in the examples considered here.[11]

These constraints clearly leave us a long way from a complete, explanatory, theory of (the acquisition of) phonology. We need further elaboration of the universals in question, and there is still an immense amount of work to be done simply in discovering the nature of the phonological systems acquired by children. In this latter area, it seems to me, various kinds of 'external' evidence, such as nativization facts, will be of critical importance--recall that there was no language-internal basis for preferring the MSR theory over the admissibility theory in the English example. (See Zwicky (1975) for a survey of other kinds of 'external' evidence, and Churma (1979) for critical discussion of some of these.) But, even though we may lack knowledge concerning the nature of the systems we are attempting to describe and explain, we must not attempt to make a virtue out of our ignorance by proposing theoretical frameworks that require only 'internal' evidence (such as a static MSC framework) in order to arrive at a unique--but clearly incorrect, in the light of 'external' evidence--account of a given phenomenon.

Footnotes

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[1]It has been questioned (cf., for example, Clayton 1976) whether the level of the morpheme is that at which the phonological constraints in question should be stated. While it seems clear that in many cases it is not, it seems equally clear that there are genuine cases of constraints on the phonological structure of morphemes, including some of those to be discussed below. It should be kept in mind, however, that while I will continue to use the traditional term here for all cases, it is not always accurate, in that it is the structure of the syllable or the word that is in question. For further discussion, cf. Kenstowicz and Kisseberth (1977).

[2]I am assuming that vowel harmony is to be treated segmentally, and not autosegmentally or metrically; for arguments to this effect, see Anderson (1980, 1982a) and Singler (1983).

[3]Rule (9') does not disallow ɛ and ɔ when preceded by i or u, contrary to what the facts are said to be by Guthrie. It is not clear that these sequences are in fact prohibited (Whitehead makes no mention of this, and Proto-Bantu--cf. Greenberg (1963)--did allow such sequences), so it is also unclear whether it would be necessary to retain (9) and provide a separate rule for intermorphemic vowel harmony. It should also be pointed out that neither version of the rule in question predicts which of a pair of mid vowels that disagree with respect to ATR will change in loan words. If there is a tendency for one set of vowels to 'dominate' the other, then this rule will have to be altered by substituting the 'dominant' feature value for the alphas.

Rule (10) as stated yields as an output a nonoccurring segment in Bobangi (a mid back unrounded vowel, assuming that a is [+back]). It would thus presumably have to be altered (given that the raising rule yields ɛ in

the environment of ɛ) by adding [-back] specifications in the appropriate places. The presumed roundedness of the output in the environment of would be accounted for by an independently required rule that makes nonlow vowels agree in backness and roundness. I leave this rule in its present form to facilitate comparison with the static admissibility approach, which does not even predict which vowel in an inadmissible sequence will change.

[4]The cited passage is taken from Clements, who apparently took it from Chomsky and Halle (1968, 387), rather than directly from Wescott's review, since both citations lack a clause present in the original: '...if /ɛ/, it does not also contain /ɔ/, /e/, or /o/...' (Wescott (1965,346)). This omission is not crucial, since, as Clements notes, this clause follows from the others present in the cited passage. Wescott himself made a more important omission of one of Thomas' claimed CMSs (see below for discussion). It is unfortunate that so much theoretical work based on Ngbaka has depended on second- and third-hand (partial) data.

[5]Nothing in the data or in Thomas' description implies the directionality specified by the MSR given, but of course the MSR framework requires such a directionality. An obvious kind of 'external evidence' to examine with respect to whether this necessity is good or bad is loan phonology, especially since Thomas (1963,62) points out that 'les emprunts' provide an 'illustration de cette tendance' [toward vowel harmony--DGC]. Unfortunately, she gives only one example of a nativization, which makes it difficult to say with any certainty what is indicated by such data. However, the single example given is in fact consistent with the directionality entailed by (17). Thus, while French régler is rendered as lagele by 'les Ngbaka lettrés' (Thomas (1963,62)), most speakers have lɛkɛlɛ. If we assume that there was an ɛ as the initial vowel in the source of this borrowing (presumably a finite form of the verb), then assimilation proceedes in the direction required. The presence of initial a in the alternative pronunciation is something of a puzzle, although it could be the result of some kind of folk etymology, whereby the initial syllable was taken to be the feminine definite article or object pronoun. In any event, it would clearly be desirable if further nativization data could be brought to bear on this issue.

[6]Perhaps the reason for Wescott's failure to mention this putative constraint is the fact that Thomas (1963,63n.) cites seven apparent counterexamples to it. However, she also points out apparent counterexamples to each of the other constraints reported by Wescott, suggesting in each case reasons for their failure to obey the constraint in question. Although she offers no explanation for the forms in question, it is clear that at least some of them are susceptible to the same kind of argument as that given for the 'quelques rares mots' (no examples given) that violate the constraint against o-ɛ and ɔ-ɛ sequences--that there are '...plusieurs composes probables: noms d'animaux, de plantes et de parties de corps' (Thomas (1963,62n.). It seems clear to me that Thomas, at least, considers the constraint in (19) to be every bit as legitimate as the others she presents; and Wescott of course presents no arguments that it is not.

[7]It is possible to 'simplify' (21) by leaving out the specifications for height (or roundness) and adding the following:

(i) [+round] C_0 [+round] is admissible
1 2 3
Condition: 1 = 3

This rule would be disjunctively ordered with respect to the revised version of (21) by the Elsewhere Condition, and would correctly specify that the only rounded vowels that can cooccur are those that are identical. The repetition of the same condition found in (15), however, is suspicious, and one might suggest that (i) and (15) should be collapsed. It does not appear that there is a reasonable way of doing so. Perhaps the most attractive proposal--that (i) and (15) should be replaced by an admissibility condition that permits any sequence of identical vowels--fails for the reasons discussed above (i.e., it fails to stand in the required 'elsewhere' relationship with (16) and (21), and so does not enforce the necessary disjunctivity).

[8]Clements and Keyser (1981) treat /šl/ (and /šw/) clusters as being on a par with /šr/ clusters--all of them being acceptable, with forms such as schwa and Schlesinger cited as evidence. (They also point out that, at least for some speakers, even more /š/-initial clusters are possible; cf., for example, shtick, schmalz, strudel, and Strauss.) As Algeo (1978) has pointed out, researchers do not always agree about which clusters are permissible in English, and he discusses a number of possible reasons for this disagreement (cf. also Clements and Keyser (1981, 30)). It seems clear that the disagreement in the case at hand is due to dialectal/idiolectal differences (with speakers who disallow /šl/ clusters apparently being in the majority--cf., for example, Whorf (1940), Hill (1958), Hockett (1958), Langacker (1972), Selkirk (1982)). I have no doubt that speakers such as those alluded to by Clements and Keyser exist (I am, for the most part, one of them), but it is equally undeniable that speakers of the type traditionally described exist, given that they nativize the offending clusters. (Evidence from slips of the tongue, where forms such as shreudian flip, for Freudian slip--cf. Langacker (1972,247)--are reported, also indicates that the the constraint against */sr/ is quite strict for such speakers.) It appears, moreover, that Clements/Keyser-type speakers are somewhat avant-garde, linguistically speaking; only linguists and others who are hyper-aware of the actual pronunciations of foreign words can survive the psycho-physiological torture required to produce the non-native clusters in question.

[9]This is probably not correct, since I know of no phonetic reason why sounds that disagree with respect to the features [anterior] and [lateral] should be so incompatible. Since [r] is, at least in my speech, [-anterior] (and cf. also Hill (1958,41), who describes the articulation of American [r] as involving 'the bunching of the tongue in the mid-mouth...'--presumably a [-anterior] articulation; he also implies that the other variety frequently described 'in older books', in which the tongue tip 'is turned upward and backward toward the roof of the mouth'--[+anterior]--is less common), while [l] is [+anterior], it is tempting to treat the phenomenon in question as an instance of assimilation with respect to the feature [anterior]; one would simply replace '[-αlateral]' in the environment of (22) by '[αanterior].' However, retroflexion of s in the environment of r-like sounds appears to be quite a common phenomenon, and the rs in question need not be [-anterior]. This occurs, for example, in

Sanskrit (where r is presumably dental or alveolar) as part of the well-known 'ruki' rule, and in Swedish, where the r is a dental trill. (I am indebted to Ilse Lehiste for bringing the Swedish facts to my attention.) The optimal, explanatory, version of (23) must thus await further investigation.

[10] If diphthongs are considered as being composed of two vowels, this claim will have to be weakened somewhat, since dissimilation of the parts of diphthongs appears to be quite common (cf. Donegan 1978).

[11] It might be suggested that these constraints be extended so that they refer, not only to natural processes, but to all phonological rules. However, it seems clear that sequences of historical changes can result in alternations that should be characterized in terms of rules (not natural processes) that are quite 'crazy' (cf. Bach and Harms 1972) or 'not natural' (Anderson (1982b)). Thus, Woleian (Sohn 1971) and related languages have a synchronic rule of vowel dissimilation which appears to be the result of a sequence of (natural) sound changes which can no longer be considered part of the synchronic system of these languages.

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